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NEW HAMPSHIRE COLLEGE

AGRICULTURAL EXPERIMENT STATION

BOVINE TUBERCULOSIS

By HERBERT H. LAMSON

EXPERIMENT STATION

NEW HAMPSHIRE COLLEGE

OF

AGRICULTURE AND THE MECHANIC ARTS

DURHAM

FIG. 1.—A portion of the chest wall from Aurora 2d studded with tubercular nodules.

BOVINE TUBERCULOSIS

BY HERBERT H. LAMSON

Everybody knows that consumption is one of the most serious diseases which afflict mankind. It is a common statement that one seventh of all deaths are due to it in some of its varied forms. Its prominent characteristics are the destruction of portions of the lungs or intestines and the rapid or gradual wasting of the other tissues with the accompanying loss of vital strength, ending in death. Hence the appropriateness of the name consumption. The above mentioned symptoms are the most striking manifestations of a general diseased condition known as tuberculosis. It is called tuberculosis because in the diseased parts are found new growths in the form of rounded masses or nodules, known as tubercles.

This disease affects the lower animals as well as man, the bovine family being especially liable to its attacks.

CAUSE

One of the most significant facts in a consideration of tuberculosis is its cause. Many diseases are caused by the subjection of the system as a whole or of particular organs to unfavorable physical conditions, such as climatic conditions, changes of temperature, exposure, undue or improper exercise, deficient or improper food, etc., which interfere with the normal function and result in *dis-ease*. Another and very important class of diseases are known as germ diseases; they are caused by the presence of germs, or micro-organisms. These micro-organisms are now generally recognized as minute plants (the smallest and simplest members of the vegetable kingdom) and are called bacteria. (For a general description of bacteria, see BULLETIN No. 68, pp. 158–164).

The disease-producing bacteria, introduced in various ways into the animal system, cause changes in the tissues or organs, which result in the manifestation of the characteristics or

symptoms of the particular disease with which they are associated. The characteristics and symptoms of the germ diseases were well known long before the causing bacteria were discovered.

During recent years the improved microscope has revealed the fact that bacteria, so abundant outside the animal body, also exist in it, especially when it is the seat of disease. Further investigation has demonstrated that certain kinds of bacteria are the cause of certain definite diseases. In no disease is the causal relation of bacteria more surely established than in tuberculosis. The bacteria which cause tuberculosis are very slender, elongated or rod-shaped organisms whose length is several times as great as their diameter. They are called tubercle bacilli. They are so small that it would require from eight to ten thousand of them, placed end to end, to measure an inch.

LESIONS OF THE DISEASE

Whenever tubercle bacilli gain entrance to the animal body, and find a chance to develop, the result is the production of a new growth in the tissues, in the form of a small, rounded body called a tubercle; from this fact the disease takes its name of tuberculosis. When newly produced, the tubercles are the size of a mustard seed or smaller; they are harder than the normal tissues and are readily detected by the sense of touch. As the disease advances the tubercles increase in number and may become massed together into larger nodules, which are frequently very numerous and of all sizes from that of the original tubercle up to that of the fist, or even larger. Being poorly supplied with blood, the tuberculous tissue has not the vitality of the normal tissues; as a consequence it has a tendency to degenerate or break down. When this has taken place, the tubercle is found to contain a yellowish material, sometimes dry and cheese-like, at other times semi-fluid and pus-like; in any advanced case such tubercles as these are abundant. There is also frequently a deposit of lime in the tubercles, which gives a gritty character to their contents. The broken-down matter may remain enclosed in the tubercle or may be absorbed, or it may break through its enclosing

walls and be thrown off, carrying with it the contained bacilli, which then become a dangerous source of infection.

INFECTION

Tubercle bacilli gain entrance to the animal body, for the most part, in two ways: either through the lungs in the air breathed, or through the digestive organs in the food eaten. The evidence afforded by the location of the tubercles points to the lungs as the more frequent point of entrance. The entrance into the system of a few bacilli does not necessarily imply that tuberculosis will follow. It has been found that the healthy tissues offer considerable resistance to the invasion of disease germs, that they even have the power of destroying such germs when they are not present in too large numbers. This resisting power may be overcome by numbers, or may be diminished by various conditions usually regarded as injurious to health in general, so that the disease germs readily gain a foothold. A moment's thought will show the importance and bearing of these facts.

Wherever may be the original site of the tubercles, they very frequently, if not usually, spread to other organs, the bacilli being carried by the lymph or the blood; the fact that the lymphatic glands are so frequently diseased points especially to the former. In the beginnings of the disease, its traces may be so slight that they readily escape detection when the animal is slaughtered; but in advanced cases, the tubercles may be found in nearly all of the internal organs; most frequently in the lungs, intestines, liver, lymphatic glands, and the lining membrane of the chest (pleura), and abdomen (peritoneum). The surface of these organs is often thickly studded with tubercular nodules which show a wide variation in size, as indicated above; sometimes their appearance is such as to lead to the use of such descriptive terms as "pearls" or "grapes." (See Fig 1.) When these nodules are cut into they show the characteristic cheesy or gritty contents. The tubercles are often found in the udder; they are seldom found in the muscles or flesh; important facts, as will be shown later.

Tuberculosis is of much slower development than the other germ diseases, and for a long time after infection the animal

may appear to be in good health. In the earlier stages the progress of the disease may become arrested and complete recovery follow; in the majority of cases, however, it progresses, sooner or later, to a fatal termination. In the later stages, the animal shows its presence by more or less characteristic symptoms.

SOURCES OF INFECTION

When the tubercles ulcerate, or break down, their contents escape into the air passages or intestines and are thrown out by these channels. The bacilli are contained in these discharges, often in great numbers. If they are coughed up and fall upon fodder of some kind which is eaten by another animal, here is an excellent chance for infection. If manure, or discharges from the lungs, containing bacilli, fall where they become dry and are later powdered by trampling or some other means, the bacilli then rise in the dust and may be inhaled and start the disease in the lungs of other animals. Cattle by licking themselves and one another furnish a way for the spread of bacilli. If bacilli are contained in the milk, calves fed upon it are exposed to infection. It is possible that an animal may be born with tuberculosis and so be said to inherit the disease from a tuberculous parent; such cases are, however, comparatively rare. The ground for the general belief that the disease is inherited, viz., the fact that the offspring of tuberculous parents frequently die of tuberculosis, is explained in this way: What is inherited is not the disease itself, but a constitution or condition of the system, which lacks the normal resistance of perfect health, and which yields readily to the invasion of tubercle bacilli.

TRANSMISSION

Can the disease be transmitted from cattle to man or from man to cattle? There is no need to dwell on the importance of this question. In its general history and behavior the disease appears to be the same in man and cattle; but there are bacteriologists who believe that there may be a difference. This, however, does not seem at present to be clearly established. With this belief in a difference is associated the

thought that, possibly, the danger of transmission from one to the other has been overestimated. But that such transmission is possible, especially from cattle to man, there seems to be abundant and reliable evidence, and this possibility should not be overlooked.

How may it be transmitted from cattle to man? While it seems possible that persons might become infected by inhaling the dust of a tuberculous stable, there is very little direct evidence of its occurrence. Man and cattle are so generally exposed to infection from their own kind through the medium of the air, that it would be very difficult to trace it with certainty from one to the other. The danger of transmission by the use of the flesh of tuberculous animals for food is, probably, not great. The bacilli and tubercles rarely invade the muscles, and are not often found in the blood. The flesh might be contaminated from the diseased internal organs during the process of slaughtering, or might inclose a small diseased gland; but such meat if well cooked would be free from danger. Heat sufficient for cooking is destructive to the bacilli. There remains to be considered the milk. If the udder is affected, the milk will in all probability contain the bacilli and there is good evidence that the milk of tuberculous animals may contain them even when there is no disease of the udder discoverable. Such milk is therefore to be looked upon as dangerous when used as food, especially by children. By far the greater number of cases of human tuberculosis, for the origin of which in infected milk the evidence seems to be conclusive, are those of children. This is so, doubtless, both on account of the comparatively greater quantity used, and the inferior resisting power of the child's system.

Milk concerning which there is any doubt may be rendered safe for food, as far as the germs of tuberculosis are concerned, by pasteurizing by heating at a temperature of 155° Fahrenheit for twenty minutes.

It may not be out of place here to call attention to the most common means of the transmission of tuberculosis from man to man, namely, by the sputum. The sputum of tuberculous persons is likely to contain the bacilli, often in great numbers; this is too often carelessly expectorated about the house, in

public halls and waiting rooms, in public conveyances, and on the street. When this expectoration dries it may readily become reduced to powder capable of floating in the air as dust, a grave source of danger to those who inhale it. There is little doubt that this is the chief method of the spread of the disease. The obvious moral to be drawn from this is,—that the greatest care should be exercised by the patient and those who care for him, that the sputum be not allowed to become a source of infection to others.

If the disease is transmitted from man to cattle it is doubtless by the same means as from man to man.

DIAGNOSIS

In dealing with tuberculosis from a practical standpoint, the detection of its presence is, of course, of the highest importance. In advanced cases there is no difficulty in deciding that there is *something* wrong with the animal. It loses flesh, it loses its sleekness of coat, and has the general appearance of being out of condition. If it is the lungs which are affected, there is likely to be a cough, which is especially noticeable after getting up or after active exercise, there are likely to be diseased glands in the throat, which show their presence by swelling or which can be detected by the touch. One who is accustomed to the practice can by placing an ear against the walls of the chest, decide by the peculiarity of the sounds which he hears, whether the lungs are solidified or broken down, or contain abnormal secretions, or have their surfaces which come in contact with the walls of the chest roughened; all of these are conditions which may be present in tuberculosis. The presence of all the foregoing so-called "physical" signs, can, in the majority of cases, establish only the probability of tuberculosis. However, there has been discovered, tried, and approved a means of detecting the disease, even in its earliest stages, when its detection by physical examination would be impossible. This means is what is known as the tuberculin test.

TUBERCULIN TEST

The general fact on which it is based is this: Bacteria under certain conditions produce new substances which are

injurious to themselves and which in many cases check their growth or otherwise affect them unfavorably. Tuberculin is such a product of the tubercle bacilli. It is made in the laboratory by cultivating the bacilli in a suitable culture fluid, in which they, during their growth, produce this new substance called tuberculin, which is dissolved in the culture fluid. The bacilli are then killed and filtered out of the liquid, which, properly diluted, constitutes the tuberculin as used for testing. If a small quantity of tuberculin is injected under the skin of a healthy animal no appreciable change takes place, but if the animal is at all affected with tuberculosis there is, after a few hours, a rise of several degrees in the animal's temperature; this is called the reaction. If the rise of temperature is two degrees or more it is looked upon as evidence that the animal is tuberculous.

The following is the usual method of procedure in testing an animal: The normal temperature is taken in the rectum with a specially constructed thermometer, once or twice before injecting the tuberculin. About two cubic centimetres—about a teaspoonful—is by means of a hypodermic syringe injected beneath the skin in the region of the neck or shoulder. It is desirable that ten or twelve hours should intervene between the injection of the tuberculin and the subsequent taking of the temperature; so for convenience it is customary to make the injections at night and to begin taking the temperatures the next morning. They are taken four or five times at intervals of two hours. As indicated above, if the animal is tuberculous we expect, sometime during the twenty-four hours following the injection, a rise of temperature of two degrees or more.

Very extended use of tuberculin in this country as well as abroad has demonstrated that it is a reliable and satisfactory test for the presence of tuberculosis; its percentage of failures is small. It sometimes fails to produce the characteristic reaction in very advanced cases—such cases as would be most readily diagnosed without its use. On the other hand, it detects cases not discoverable by any other means. There is abundant testimony that its use is not in any way injurious to a healthy animal.

WHAT SHALL BE DONE WITH AN ANIMAL THAT HAS BEEN FOUND TO BE TUBERCULOUS?

The diseased animal should be removed from the healthy ones and kept isolated from them. The stable should be disinfected.

If the general appearance and physical signs of the condemned animal indicate that it is badly affected the wisest course to pursue is to kill it and bury or burn its carcass. If, on the other hand, the animal appears to be in fair condition, and if physical examination fails to show any serious progress of the disease, there seems to be a growing opinion that there is no need of the animal's becoming a total loss. It should certainly be kept isolated from healthy animals. With good care it may recover completely. If it is a blooded animal or otherwise especially valuable, it may be used for breeding purposes. If in milk, the milk may be used for feeding purposes; but should first be pasteurized by heating to 155 Farenheit for 15 or 20 minutes. The animal may be fattened for beef if slaughtered under competent inspection.

The herd should be retested from time to time and the diseased ones weeded out; new animals should not be added to it, except by birth, which have not passed the tuberculin test.

DISINFECTION

When a case of tuberculosis has been found in a stable it is desirable that the stable should be disinfected. In order that it may not be time wasted, it should be done thoroughly. The hay, straw, chaff, dust, manure, etc., should be removed and burned. If the removal is likely to be a dusty job, it would be well to moisten it with water or the disinfecting solution. If any portion of the stable is incrusted with dried dirt or manure, it should be moistened with the disinfectant and scraped off with a hoe or other convenient implement. All the exposed surfaces of the stable should be thoroughly wet with a solution of corrosive sublimate of the strength of one part of corrosive sublimate to one thousand parts of water—60 grains per gallon. It should be borne in mind that this solution is very poisonous if taken internally. Before the stable is again used the mangers

should be freely rinsed with water to remove the corrosive sublimate. It should not be mixed or used in metallic vessels. It may be applied with a broom, swab, or brush. Another plan which is, perhaps, equally effective, is to wash the floors and mangers with corrosive sublimate and to whitewash the rest of the stable.

TUBERCULOSIS IN THE COLLEGE HERD

After the burning of the college barn, November 3, 1894, the cattle were stabled: part in an old barn on the College farm, and part of them in a neighboring barn. November 19 and 20 the herd, numbering 55, was tested with tuberculin by Dr. F. A. Rich of Burlington, Vt. Eight of the cattle—14½ per cent—reacted. One case was considered suspicious. The temperatures recorded are given in table I. Of the condemned animals two, the Jersey bull and Clio, were killed the next day; both showed the characteristic lesions of the disease. The remaining ones were isolated in a portion of the stable partitioned off from the rest of the herd. They were kept here until the weather became warm enough for them to live out of doors, when they were transferred to an open shed at the rear of the barn; when cold weather came again they were put in an isolated stable. During the time of isolation they received ordinary care simply.

March 1 and 2, 1895, the herd was again tested by Dr. Rich. Two more animals reacted, Nora 2d and Aurora 2d; they were placed with the other condemned animals in quarantine. The temperatures taken at this test are given in table II.

The temperatures of the condemned animals at these two tests and their reactions are given in a separate table. Table III.

TABLE I

TUBERCULIN TEST, NOVEMBER 19 AND 20, 1894.
The temperatures are given in degrees and tenths of a degree, Fahrenheit.

	Nov. 19.	November 20.			
		7 A. M.	9 A. M.	11 A. M.	2 P. M.
Durhams.					
George (Bull)	101.0	102.5	103.2	103.4	102.4
Nora 2d	100.2	102.2	101.2	101.0	101.6
Nora 3d					
Sea Breeze					
Duchess	103.0	104.2	104.0	103.8	103.4
Dandelion	101.0	100.0	100.6	100.0	101.5
Duchess of D	101.8	102.5	102.5	102.5	101.6
Duchess 2d	101.4	101.4	102.0	100.8	102.0
Durham 6	101.4	106.6	106.6	105.8	106.2
Aurora 2d					
Durham, No. 11	102.8	102.4	103.5	103.4	103.0
" No. 12	101.8	101.8	101.6	102.6	102.8
" No. 14	101.8	101.2	100.8	101.4	101.4
" No. 15	100.0	102.0	102.2	102.0	102.0
" No. 7	101.8	103.2	102.6	102.6	102.6
" No. 16	102.2	103.6	102.6	102.0	103.6
" No. 17	102.5	99.6	101.4	102.2	101.8
" No. 18	103.0	102.6	102.2	102.4	101.8
" No. 19					
Jerseys.					
Jersey 49	101.0	105.8	106.4	106.0	106.0
Pilot's Lily	101.5	103.8	104.4	104 8	103.5
Princess, Jr	100.6	102.2	103.6	106.0	106.0
Pink, Jr	101.0	101.2	100.6	100.8	101.4
Pilot's Jr	102 2	102.0	101.8	101.8	102.0
Daisy					
Jersey, No. 9	102.5	101.8	102.6	102.6	101.8
" No. 11	101.4	102.6	101.6	101.5	102.0
" No. 13	102.6	101.5	102.5	102.6	102 5
" No. 17	101.8	103.0	102.4	102.4	101.6
" No. 14					
Ayrshires.					
Maid of Arles	99.0	103.6	103.2	105.2	104.0
Chinchilla	101.0	105.6	105.8	105.5	104.6
Frost	101.6	102.8	104.2	105.0	104.5
Clio	101.4	106.2	106.2	105.6	104 6
Frost, Jr					
Ayrshire, No. 5, Bona	101.0	101.2	101.6	101.6	101.8
" No. 9, Bess	102.2	101.6	103.2	103.8	102.2
" No. 10, Bonnie	101.0	102.0	102.0	102.0	101.6
" No. 11	101.6	102.2	102.0	102.0	102.0
" No. 12, Belle	101.8	102.6	101.2	102.0	101.6
" No. 14	101.0	101.8	102.0	101.8	102.0
" No. 15	101.8	102.4	101.0	100.8	101.8
" No. 16	101.2	102.4	101.4	101.4	101.0
" No. 17	101.0	101.6	101.4	101.0	100.8
" No. 18	102.4	102.5	102.4	101.2	102.2
" No. 19	102.2	101.6	102.6	102.0	102.0
" No. 20	102.4	101.2	101.8	101.8	102.6
" No. 21	102.2	101.8	102.4	102.0	102.4
" No. 23	101.8	102.5	102.4	102.6	102.8
" No. 24	102.2	101.2	102.2	102.5	102.8
" No. 25	102.0	101.5	101.8	102.2	102.6
" No. 26					
" No. 27					
" No. 28					
" No. 29, Georgia					

TABLE II

TUBERCULIN TEST, MARCH 1 AND 2, 1895.

	March 1.		March 2.					
	10.35 A. M.	1.40 P. M.	7.30 A. M.	9.30 A. M.	10.30 A. M.	Noon.	2.00 P. M.	4.00 P. M.
Durhams.								
George (Bull)	102.0	102.8	101.4	101.8	102.8	103.2	103.3	103.0
Nora 2d	101.6	102.6	101.6	103.8	.....	105.0	105.4	104.2
Nora 3d	102.8	102.2	100.6	102.0	.....	101.8	101.4	101.6
Sea Breeze	102.8	103.0	101.6	102 6	.....	102.2	102.6	102.4
Duchess	102.2	102.0	101.6	102.2	.....	102.0	102.4	102.4
Dandelion	102.0	102.0	102.2	103.0	.....	102.5	102.0	101.6
Duchess of D	102.2	101.6	101.0	101.6	.....	101.6	101.6	101.6
Duchess 2d	102.2	101.8	102.0	102.2	.....	102.0	102.2	102.0
Durham, No. 6	102.0	102.4	102.6	103.2	102.8	106.0	106.0	104.6
Aurora 2d	101.8	102.0	104.0	105.0	105.0	.....	103.8	.....
Durham, No. 11	101.8	102.0	101.8	102.0	.....	102.0	101.6	102.0
" No. 12	103.2	102.0	102.0	102.0	.....	102.2	101.6	101.8
" No. 14	101.8	101.6	101.6	.....	101.2	.....	101.6	.....
" No. 15	102.0	102.2	101.8	.....	102.2	.....	102.2	.....
" No. 7	102.8	102.8	102.2	.....	101.6	.....	102.2	.....
" No. 16	102.6	102.6	.....	102.2	.....	.....	.....	.....
" No. 17	103.0	103.0	.....	102.4	.....	.....	.....	.....
" No. 18	103.6	102.6	.....	102.2	.....	.....	.....	.....
" No. 19	101.8	102.8	.....	.....	.....	.....	.....	.....
Jerseys.								
Pilot's Lily	101.4	101.4	101.4	103.4	103.2	103.0	102.0	102.6
Princess, Jr.	101.8	102.8	102.6	104.0	105.0	106.0	106.0	105.0
Pink, Jr	101.8	101.8	101.4	.....	101.6	.....	101.2	.....
Pilot's Jr	101.0	101.6	101.4	101.6	.....	101.4	101.6	101.2
Daisy	101.0	102.2	101.6	102.0	.....	101.4	.....	102.2
Jersey, No. 9	101.0	101.8	102.2	102.2	.....	101.8	102.2	101.6
" No. 11	101.0	102.2	102.0	102.2	.....	101.8	101.6	101.4
" No. 13	102.0	102.2	102.4	102 0	.....	101.6	101.6	101.6
" No. 17	101.6	101.4	100.8	.....	101.6	.....	101.6	.....
" No. 14	101.0	101.6	101.6	.....	101.6	.....	101.6	.....
Ayrshires.								
Maid of Arles	101.2	101.6	102.2	104.6	105.4	.....	.....	.....
Chinchilla	101.6	101.2	102.6	104.0	104.4	.....	.....	.....
Frost	.....	.....	.....	.....	.....	.....	.....	.....
Clio	.....	.....	.....	.....	.....	.....	.....	.....
Frost, Jr	101.6	102.0	101.4	101.4	.....	101.4	101.4	100.6
Ayrshire, No. 5, Bona	102.0	101.2	101.0	.....	101.8	102.0	.....	.....
" No. 9, Bess	101.0	101.8	102.2	102.0	.....	102.2	102.4	102.4
" No. 10, Bonnie	101.4	101.8	101.8	101.4	.....	101.6	101.6	101.6
" No. 11	102.4	101.0	101.2	.....	101.8	.....	102.0	.....
" No. 12, Belle	101.6	102.2	101.8	101.8	.....	101.4	101.6	101.6
" No. 14	102.0	102.2	102.0	.....	101.6	.....	101.8	.....
" No. 15	101.0	101.8	101.6	.....	101.0	.....	101.6	.....
" No. 16	101.4	102.6	101.6	.....	101.6	.....	102.0	.....
" No. 17	102.0	102.2	101.4	102.0	.....	101.4	102.0	102.2
" No. 18	102.6	102.6	.....	101.8	.....	.....	.....	101.8
" No. 19	101.6	102.2	.....	101.4	.....	.....	.....	101.6
" No. 20	102.6	101.8	.....	101.4	.....	.....	.....	101.4
" No. 21	102.2	102.0	.....	102.0	.....	.....	.....	101.6
" No. 23	101.8	103.0	101.6	.....	102.0	.....	102.2	.....
" No. 24	102.4	102.8	101.8	.....	102.2	.....	102.2	.....
" No. 25	102.2	103.0	102.2	.....	102.2	.....	102.0	.....
" No. 26	101.6	102.0	102.2	.....	.....	.....	.....	.....
" No. 27	102.8	102.2	102.2	.....	.....	.....	.....	.....
" No. 28	103.6	102.8	102.2	.....	.....	.....	.....	.....
" No. 29, Georgia	101.8	101.8	101.4	.....	101.4	.....	101.6	.....

TABLE III

TEMPERATURES OF CATTLE REACTING, NOV. 20, 1894.

	Normal.		After inoculation.					Amo'nt of reaction.
Pilot's Lily	101.5	.....	103.8	105.4	104.8	103.5	.....	3.9
Jersey 49 (Bull)	101.0	.....	105.8	106.4	106.0	106.0	.....	5.4
Maid of Arles	99.0	.....	103.6	103.2	105.2	104.0	.....	6.2
Chinchilla	101.0	.....	105.6	105.8	105.5	104.6	.....	4.8
Durham, No. 6	101.4	.....	106.6	106.6	105.8	106.2	.....	5.2
Princess, Jr	100.6	.....	102.2	103.6	106.0	106.0	.....	5.4
Frost	101.6	.....	102.8	104.2	105.0	104.5	.....	3.4
Clio	101.4	.....	106.2	106.2	105.6	104.6	.....	4.8
George	101.0	.....	102.5	103.2	103.4	102.4	.....	2.4
TEMPERATURES OF CATTLE REACTING MARCH 2, 1895.								
Nora 2d	101.6	102.6	101.3	103.8	105.0	105.4	104.2	3.3
Aurora 2d	101.8	102.0	104.0	105.0	105.0	103.8	.....	3.1
PREVIOUSLY REACTED.								
Pilot's Lily	101.4	101.4	101.4	103.4	103.2	103.0	103.0	2.0
Maid of Arles	101.2	101.6	102.2	104.6	105.4	.....	.....	4.0
Chinchilla	101.6	101.2	102.6	104.0	104.4	.....	.....	3.0
Durham, No. 6	102.0	102.4	102.6	103.2	106.0	106.0	104.6	3.8
Princess, Jr	101.8	102.8	102.6	105.0	106.0	106.0	105.8	3.7
George	102.0	102.8	101.8	102.8	103.2	103.6	103.0	1.2

Notes in Regard to the Condemned Cattle.

Jersey bull, two years old, apparently in the best of health but showed a high reaction to tuberculin, 5.4 degrees. Killed November 22, 1894. Autopsy showed one or two slightly diseased glands and a tuberculous nodule about the size of a hickory nut in one lung.

Clio, Ayrshire cow. Reaction 4.8 degrees. Killed November 22, 1894. Autopsy showed rather extensive disease of the lungs.

Frost, Ayrshire cow. Reaction 3.4 degrees. Killed December, 1894. Autopsy showed one lung badly diseased.

Chinchilla, Ayrshire cow. Reaction 4.8 degrees. Killed March 2, 1895. Autopsy showed tubercular lesions.

Maid of Arles, Ayrshire cow. Reaction 6.2 degrees. Killed March 2, 1895. Autopsy showed tubercular lesions.

Pilot's Lily, Jersey cow, ten years old. Reaction, first test, 3.9 degrees; second test, 2 degrees. Killed March 7, 1896. Autopsy showed: Right lung adherent to the diaphragm, posterior mediastinal glands enlarged and containing cheesy matter, apex of posterior lobe of one lung solidified.

Princess, Jr., Jersey cow, 6 years old. Reaction, first test, 5.4 degrees; second test, 3.7 degrees. Killed December 24, 1895. Autopsy showed: Large tubercular mass in posterior lobe of left lung; two small nodules in right lung, numerous lesions in the liver, and several diseased glands.

Aurora 2d. Durham cow, 10 years old. Reaction, 3.1 degrees. Killed December 24, 1895. Autopsy showed: Portions of the surface of the lungs, pleura, spleen, and liver studded with tubercles of varying size.

Durham No. 6, Durham cow, 3 years old. Reaction, first test, 5.2 degrees; second test, 3.8 degrees. Killed March 7, 1896. Autopsy showed: Right lung adherent by upper surface and containing a large cavity, several tuberculous nodules in the liver.

Nora 2d, Durham cow, 10 years old. Reaction, 3.3 degrees. Killed September, 1896. Autopsy showed: Mediastinal glands tuberculous, large cavity in left lung, diseased gland on liver.

No tubercular lesions were found in the udders of any of the condemned cows.

George, Durham bull, two years old. Reaction, first test, 2.4 degrees; second test, 1.2 degrees; third test December 5, 1895, 1.1 degrees. At the time of the first test there were circumstances which raised a question as to whether the apparent reaction was due to the presence of tuberculosis; it was regarded as a *suspicious* case only. After the third test he was removed from quarrantine. A

subsequent test previous to selling showed no reaction. A doubtful, but possible, case of recovery.

Bessie, Ayrshire cow, five years old. At a test made December 5 and 6, 1895, previous to transferring the herd to the new barn (see Bulletin 31). Bessie showed a reaction of 4.6 degrees; she was condemned and placed in quarantine. December 19 and 20, 1895, she was tested again and showed a reaction of 2 degrees. In September, 1896, she was tested a third time but failed to show a reaction. She was killed, however, and a careful examination at the autopsy showed no traces of the disease. A probable case of recovery.

Experiments with the milk of the condemned cows:— An effort was made to determine whether bacilli were present in the milk of the condemned cows by microscopical examination, by inoculation of guinea-pigs, and by feeding calves with it.

INOCULATION OF GUINEA-PIGS WITH MILK OF TUBERCULOUS COWS

December 29, 1894. Began inoculation of guinea-pigs with milk from the tuberculous cows. The following was the general method of procedure: The udder and hind quarters of the cow were cleaned with a brush, when necessary, and then thoroughly moistened with water by means of a sponge to prevent any falling of dust from the cow into the milk. The milk was then drawn into sterilized flasks; from these flasks the milk used for inoculation was drawn.

The hair on the belly of the guinea-pig, at the point chosen for inoculation, was clipped off with scissors and the surface of the skin was scrubbed with dilute carbolic acid. The milk was then injected into the peritoneal cavity by means of a sterilized Koch syringe.

December 29. Inoculated a male guinea-pig (No. 1) with 1 cubic centimetre of milk from Durham No. 6. The milk used was the first drawn from the udder at night.

January 2, 1895. Inoculated a male guinea-pig (No 2) with 1 cubic centimetre of morning's milk from Durham No. 6. The milk was a mixture of the first milk and the strippings.

January 5. Inoculated a male guinea-pig (No. 3) with 2 cubic centimetres of night's milk from Pilot's Lily. The injection was partly subcutaneous. The sample used was from the first milkings.

January 7. Inoculated a female guinea-pig (No. 4) with 1 cubic centimetre of milk from Chinchilla; sample used, first of night's milking.

January 9. Inoculated a male guinea-pig (No. 5) with 1 cubic centimetre of milk from Maid of Arles, from first milkings at night.

February 9. Inoculated a male guinea-pig (No. 6) with 2 cubic centimetres of milk from Chinchilla. Sample used taken from first milkings at night.

February 16. Inoculated a male guinea-pig (No. 7) with 2 cubic centimetres of milk from Pilot's Lily. Sample used taken from first milkings at night.

February 28. Inoculated a female guinea-pig (No. 8) with 2 cubic centimetres of milk from Maid of Arles. Portion used taken from first milkings and strippings at night.

March 8. Inoculated a female guinea-pig (No. 9) with 2 cubic centimetres of milk from Durham No. 6. The sample used was from the whole morning's milk, which was less than half a pint.

March 9. Inoculated a female guinea-pig (No. 10) with two cubic centimetres of milk from Durham No. 6. The portion used was from the whole morning's milking, about 3 fluid ounces.

April 4. Inoculated a male guinea-pig (No. 11) with 3 cubic centimetres of milk from Pilot's Lily. The portion used was from strippings at night.

April 6. Inoculated male guinea-pig (No. 12) with 3 cubic centimetres of milk from Pilot's Lily. The sample used was taken from a mixture of the first milkings and strippings.

April 10. Inoculated a female guinea-pig (No. 13) with 4 cubic centimetres of milk from Nora 2d. The portion used was from the mixed first milkings and strippings at night.

April 10. Inoculated a male guinea-pig (No. 14) with two cubic centimetres of milk from Pilot's Lily. Portion used was from first half pint of night's milking.

May 31. Inoculated male guinea-pig (No. 15) with 3 cubic centimetres of milk from Pilot's Lily. Sample used from night's milk.

June 4. Inoculated a guinea-pig (No. 16) with 3 cubic centimetres of milk from Pilot's Lily. Sample used from night's milk.

June 4. Inoculated male guinea-pig (No. 17) with 1 cubic centimetre of milk from Aurora 2d.

June 10. Inoculated a female guinea-pig (No. 18) with 4 cubic centimetres of milk from Pilot's Lily. Sample used from first half of morning's milking.

June 11. Inoculated male guinea-pig (No. 19) with 4 cubic centimetres of milk from Pilot's Lily. Sample used from morning's milk.

June 15. Inoculated female guinea-pig (No. 20) with 4 cubic centimetres of milk from Pilot's Lily. Sample used from morning's milk.

After a sufficient length of time had elasped for the disease to develop, the inoculated pigs were examined; the autopsy failed to show any case of tuberculosis.

Two calves were fed for about three months with the milk of the condemned cows. When subsequently tested with tuberculin, they showed no evidence of the disease.

Numerous samples of the milk of the condemned cows were examined microscopically but no bacilli were found.

SUMMARY

Eight animals, 14½ per cent. of the herd of fifty-five, were, by the tuberculin test, pronounced tuberculous.

Four months later two new cases were found; nine months later still another case was found. This shows the advisability of testing a herd at least once a year.

All of the animals whose final test showed a reaction were at the autopsy found to have the disease.

One condemned animal apparently recovered.

No evidence of the presence of the bacilli in the milk of the tuberculous cows was found.

Closing Word

In the very active campaign against tuberculosis, of a few years ago, excessive and unwise measures may have been recommended and used; and it may be that too great indifference has followed. The fact should not be lost sight of, however, that tuberculosis is a very serious disease, causing great loss among domestic cattle, and to a certain extent endangering human life. Continuous, united, and intelligently directed effort should be made to check its ravages.